DESCRIPTION

Field of Application

The present invention broadly relates to a method for making a retaining net, of the kind that is employed for example to hold off land and rocks, snow and avalanches, so called rock fences and avalanche fences, and particularly to a method for making a knot of said retaining net, to a knot formed by means of said method and to a junction for said knot.

Prior Art

In the field of retaining nets, of the above-referred type, such as rock fences, avalanche fences and the like, there is the need of securing the strength of the knots, which is of those points in which two wire ropes cross over and are thereof tyed together by means of a junction.

The traditional method for tying the ropes together in the knot by means of a ligament or very knot between ropes provides a fairly strong bond, but it is time-intensive and hardly suitable for automated processing.

It has been suggested the use of a conventional U-bolt clamp, located where the ropes ross over, with respective U-bolt and thightening nuts. Even if good strength is thus achieved, because the sliding of the knot ropes is made impossible and so there is the undesired widening of the net mesh, this distorts, where ropes cross over, the geometries of the individual meshes and so the overall geometry of the net.

Junctions have been devised, being formed by means of two plate-shaped elements located at the opposite ends of the intersection between the two ropes and closed on themselves because of their bending upon each other, with subsequent formation of a sort of boss. These junctions allow to realize the knot in a fast way, by means of

Express Mail Label
EV347799935US

tools, which is a relatively simple press. Anyway these junctions, despite of a series of following improvements, are still unsatisfactory as for their resistance against impulsive stimulus.: for instance a falling rock can determine, because of the impact with the net, the opening of the junction, often with distance projection of one or both the plate-shaped elements, in a projectile style, with immediate widening of at least a mesh of the net and causing danger for people. The underlying problem of this invention is to provide a method for making retaining net knots, satisfying the above-referred requirement and overcoming drawbacks of the prior art.

Summary of the Invention

The above problem is solved by a method according to Claim 1.

Brief Description of the Drawings

Further features and advantages of the invention will become apparent from the following description of an embodiment thereof, given by way of non-limitative example with reference to the accompanying drawings.

Figure 1 is a perspective view of a retaining net according to the invention.

Figure 2 is a schematic view, exploded and perspective, of a detail of the net shown in Figure 1, specifically of a knot according to the invention.

Figures 3 and 4 are perspective views of an embodiment of the knot according to the invention,seen from two different angle shots.

Figure 5 is a partial section of the side view of the knot shown in Figure 2.

Figure 6 is a side view of the knot of Figure 5, taken in the direction of arrow VI.

Figure 7 is a front view of the knot of Figure 5, taken in the direction of

arrow VII.

Figure 8 is a perspective view of an element of the knot shown in Figure 2.

Figure 9 is a partial section of the side view of the knot shown in figure 2, according to a modified embodiment of the invention.

Detailed Description of the Invention

With reference to the drawings, figure 1 globally shows a retaining net, for retaining land, rocks, snow and avalanches, e.g. a so-called rock fence, according to the invention.

The net 1, that can be rolled up into coils of diameter D, comprises a plurality of warp ropes 2 and a plurality of woof ropes 3 crossing one another at right angles in correspondance of knot points 4 to define meshes 5, square-shaped meshes in this example. The net 1 is meant to operate outstretched, for example stretching hillside, in order to protect roads from falling rocks..

For each knot 4 (Figure 3), ropes 2 and 3 extend along directions x-x and y-y respectively, perpendicular to a direction z-z.

The ropes 2 and 3 are made of twisted steel strands. In this example, each rope has seven strands and each strand comprises seven wires. The ropes 2 and 3 of this example are all identical and have a diameter d of 8 mm.

Each knot comprises, besides crossing ropes 2 and 3, a junction 6 binding the ropes together in correspondance of the knot, so as to prevent ropes from detaching and sliding with respect to each other.

The junction 6 comprises a first and a second U-shaped elements 7 and 8. These U elements 7 and 8 are made of a steel cylindrical bar, which is a steel rod, whose diameter is dt, conveniently bent. In this example, dt=8 mm.

The first U element 7 has a curved base 7a, and two parallel wings 7b and 7c, with respective ends 7d and 7e. The same can be observed for U element 8, which has a curved base 8a, two parallel wings 8b and 8c, with respective ends 8d and 8f.

The curvature of the curved bases 7a, 8a is semicircular, with an intrados radius R being approximately one half the rope diameter d, in this case about 4 millimeters.

The two U elements 7 and 8 are positioned side-by-side astride the first rope 2, with their wings equally oriented in the direction z-z, in substance adjacent, at a reciprocal distance approximately equal to d, so that they lie close to the second rope 3 on opposite sides thereof.

The junction further comprises at least a bridge element 9, connecting the ends 7d, 7e of the U element 7 to the adjacent ends 8d, 8e of the U element 8. This bridge element 9 is bridge extended on the second rope 3 parallel to the direction x-x of rope 2 and perpendicularly to the direction y-y of rope 3, and it is then clamped on said rope 3 with clamping means globally shown with 10.

Advantageously, the bridge element 9 consists of an arch 9d and a yoke 9e, both lying in respective parallel planes and perpendicularly to the direction y-y of rope 3.

The arch 9d is formed by a steel cylindrical bar, which is a steel rod, conveniently bent, and it merges with the ends 7d, 8d of the two U elements 7, 8 and is integral with the latter. The curvature of the arch 9d is semicircular with an intrados radius equal to R.

This unique piece (see figure 8), generally shown with 11, is obtained by bending a steel cylindrical bar, which is a steel rod, whose diameter is dt, and it is preferably zinc-galvanized and it has distance, indicated with h, between tangent line t9 at the intrados of arch 9d and the plane defined by tangent lines t7, t8 at the intrados of curved bases 7a, 8a. The distance h varies between 1 and 4/3 the rope diameter d. In this

example, h=d.

The yoke 9e is a steel parallelepiped bar, preferably zinc-galvanized. It has a semicylindrical depression 12 of radius R located midway of its length and faced to the rope 3 and two holes 13, 14 through which it is fit in a sliding way on the legs 7e, 8e of the two U elements 7, 8.

The clamping means 10 comprise two thread nuts 15 and 16, preferably zinc-galvanized, which are involved in the screwing with respective screw threads 17 and 18 provided at the ends 7e and 8e. The desired clamping is obtained by tightening up the nuts, thus provoking the pressing contact of the yoke 9e on the rope 3 and, as a reaction, the pressing contact of arch 9d on the same rope.

After the clamping, the ropes 2, 3, in correspondence of their crossing over area, press each other because of the displacement of the contacting strands,reducing their overall thickness of 1 to 4/3 the diameter d. In this way, the ropes 2 and 3 are forced to lie substantially in the same plane at each knot 4 of the net 1.

Preferably, during the clamping, a product against the unscrewing of the screw threads is applied. Alternatively, the threads could be locally deformed by means of burin and hammer.

According to a modified embodiment of the invention, junction 6 comprises clamping means 20 composed of two heads 21 and 22 respectively formed integrally in correspondence of the ends 7e and 8e of the wings 7c, 8c of the U elements 7 and 8. Because of the upsetting the heads 21 and 22 are forced to lean on yoke 9b. Being the heads 21 and 22 practically indestructible, also the clapping means 20 are irreversible, and the junction comes out to be inviolable.

A method of making retaining net knots, such as rock fences or avalanche fences, wherein a knot consists of a first and a second wire ropes crossing over each other and a binding junction of said ropes, comprises the steps of placing a first and a second U element astride

said first rope and close to said second rope on opposite sides thereof, of linking the ends of the first U element to the ends of the second U element by means of at least one bridge element overlying said second rope, and of clamping said at least one bridge element on said second rope.

The main advantage of the invention is the high machanical strength reached by the net, both under static and impulsive stimulus: the junction according to the invention holds the ropes together like a ligament where they cross over and it forms a whole which is impossible to be divided into portions.

Another advantage is the excellent life expectancy of of the junction, being formed by massive elements.

In addition, the knot can be formed by means of relatively simple tools, such as presses, with screwers or riveters .

The net formed with knots according to the invention has also the advantage of being easily rolled up, also in coils with a small diameter, practically the one of the rope, which is important as far the transport and use while operating is concerned.

It should be noticed, moreover, that the junction binds the ropes firmly together without affecting their machanical strength. This is achieved because all the elements of the junction act on the ropes according to geodetic curves perpendicular to the axe of the ropes and to the direction of the rope twisting helix.

Obviously a skilled person in the art could make changes and modifications as for the disclosed method and junction, in order to satisfy specific, contingent needs, being all the modifications under the scope of the invention as defined in the following claims.